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(54) **ADJUSTMENT MECHANISM FOR MOVABLE PLATEN**

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B29C 45/66 (2006.01)

(52) **U.S. Cl.**
CPC ***B29C 45/1761*** (2013.01); *B29C 45/1744* (2013.01); *B29C 45/661* (2013.01); *B29C 2045/1784* (2013.01); *B29C 2045/662* (2013.01)

(58) **Field of Classification Search**
CPC B29C 45/1744; B29C 45/1761; B29C 2045/1784
See application file for complete search history.

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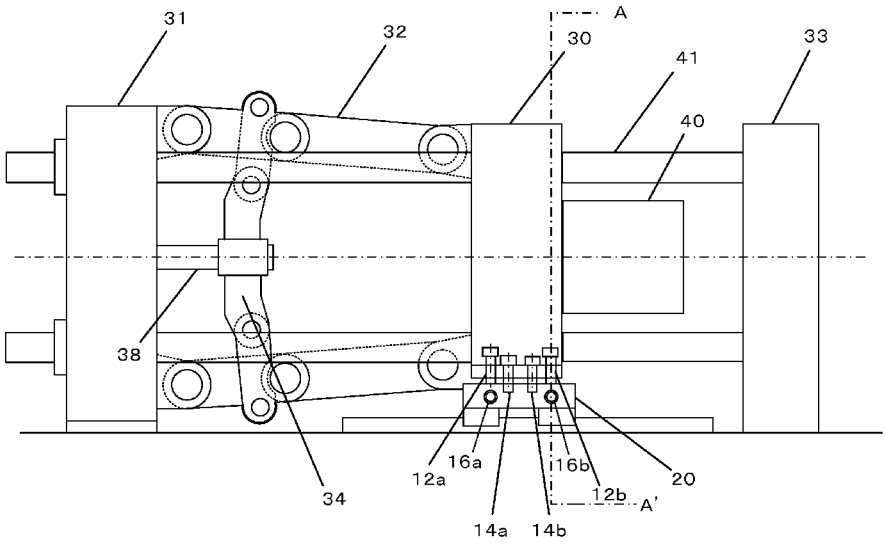
(57) **ABSTRACT**

An adjustment mechanism for a movable platen of an injection molding machine is provided with a push bolt, configured to apply a force to push up the movable platen against a gravitational force, and a pull bolt, configured to apply a force to draw in the movable platen in the direction of gravity. The movable platen is adjusted by regulating its height above a base of the molding machine in a plurality of positions at different distances from a fixed platen.

4 Claims, 3 Drawing Sheets



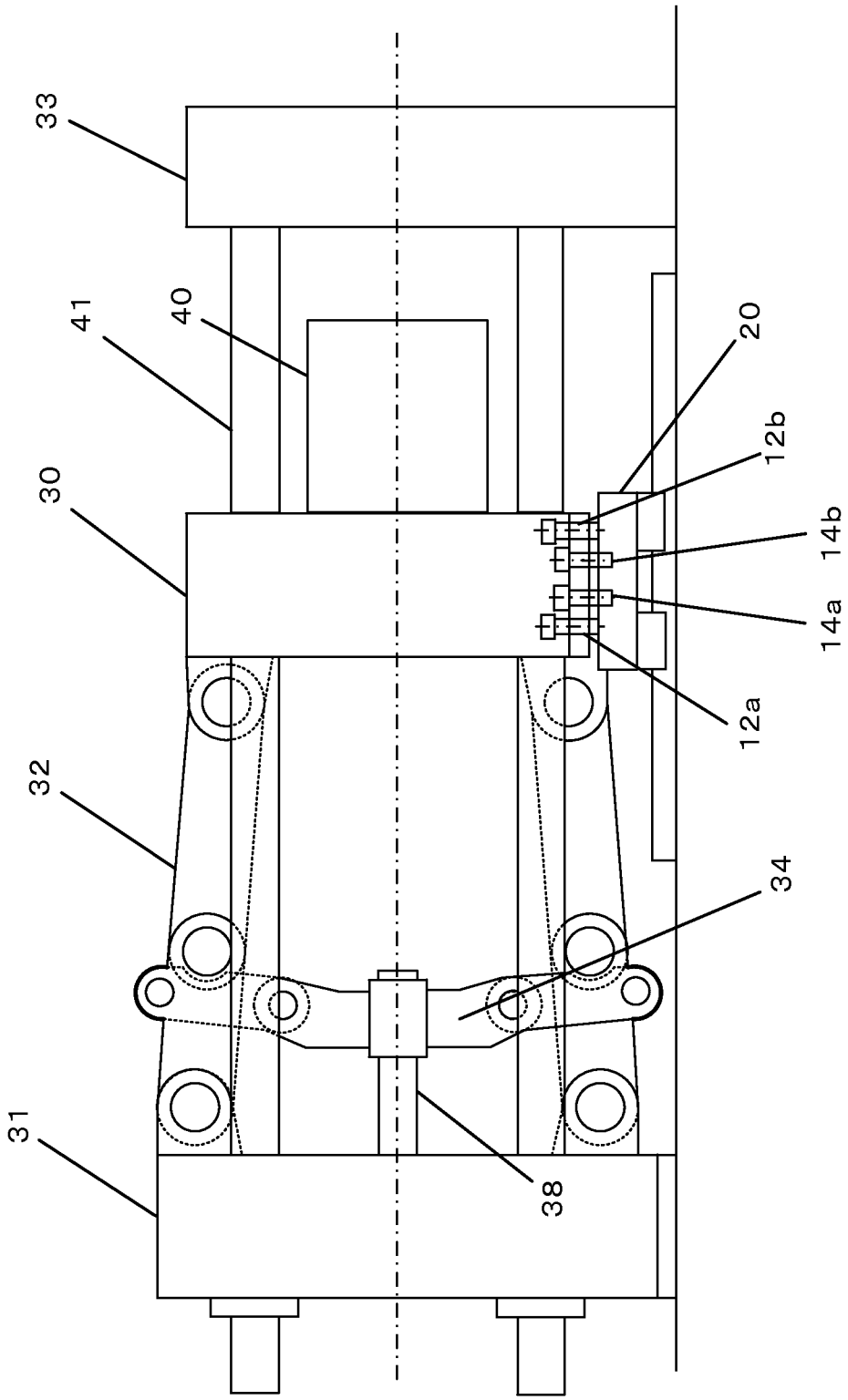


FIG. 1

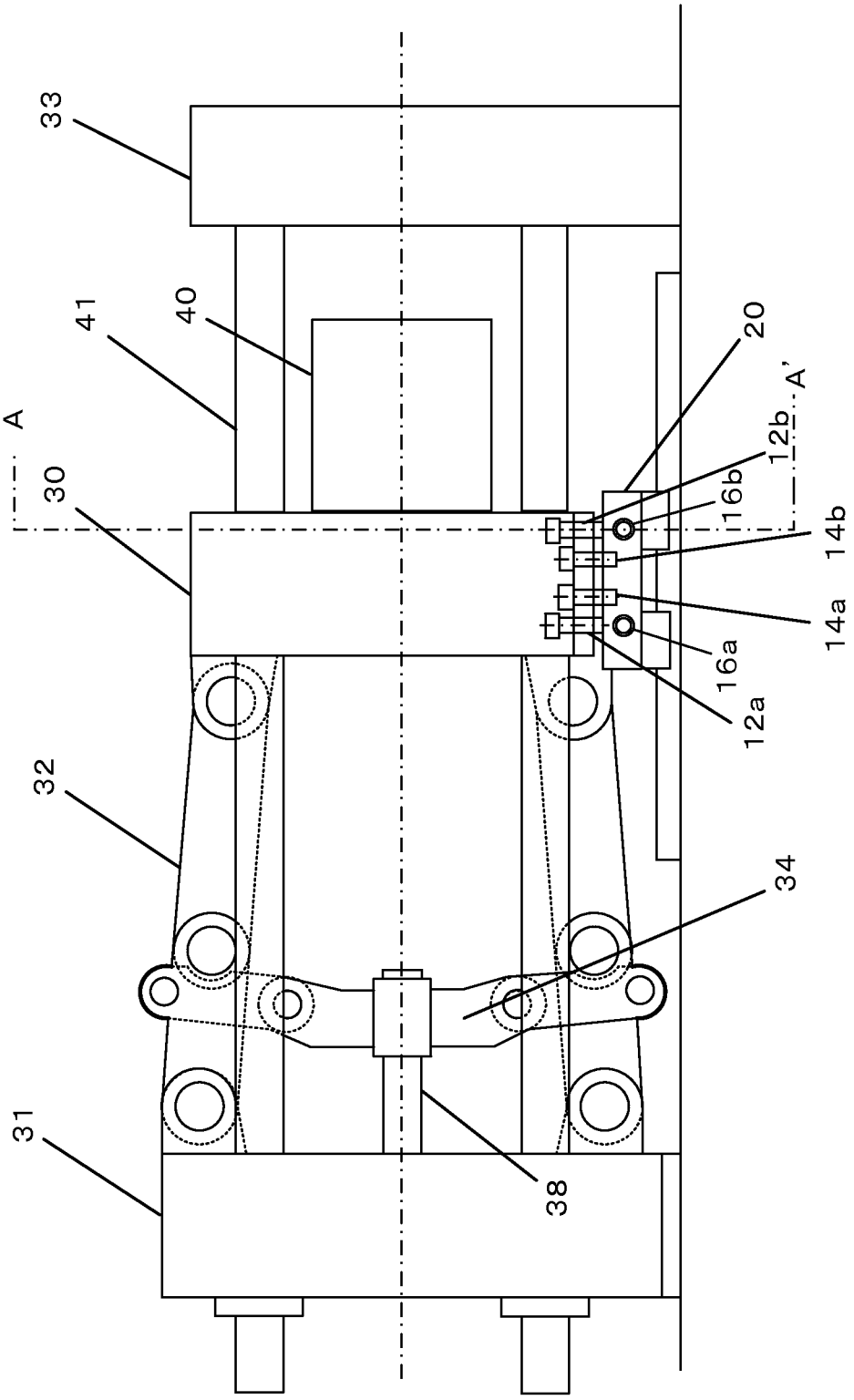


FIG. 2

FIG. 3

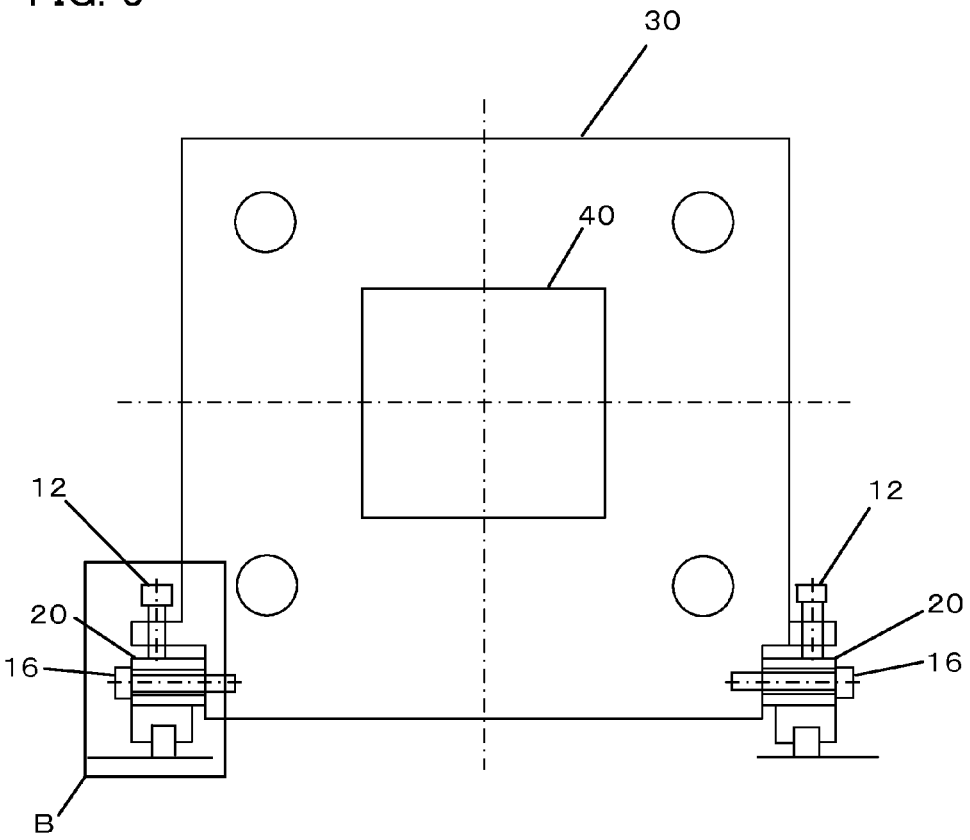
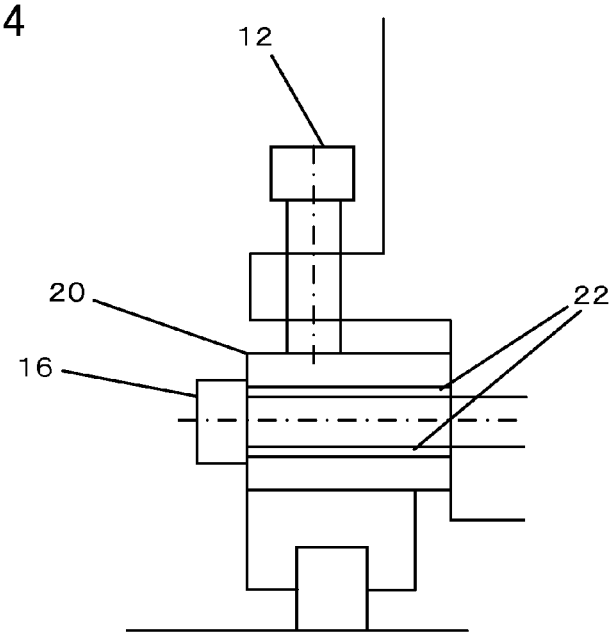


FIG. 4



ADJUSTMENT MECHANISM FOR MOVABLE PLATEN

RELATED APPLICATIONS

The present application claims priority to Japanese Application No. 2013-209066, filed Oct. 4, 2013, the disclosure of which is hereby incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1 . Field of the Invention

The present invention relates to an adjustment mechanism for a movable platen used in an injection molding machine.

2 . Description of the Related Art

FIG. **1** is a view showing a mold clamping unit of an injection molding machine. The mold clamping unit comprises a movable platen **30**, rear platen **31**, toggles **32**, fixed platen **33**, crosshead **34**, and ball screw shaft **38**. The rear platen **31** and the fixed platen **33** are connected by a plurality of tie-bars **41**, and the movable platen **30** can be advanced (to the right in FIG. **1**) toward and retracted (to the left in FIG. **1**) from the fixed platen **33** by the toggles **32**.

A mold **40** is mounted on the movable platen **30**. The position of the movable platen **30** can be changed by advancing or retracting the crosshead **34** on the ball screw shaft **38**. If the crosshead **34** is advanced (to the right in FIG. **1**), in this case, the movable platen **30** is advanced to close the mold.

In precision molding such as lens molding, the parallelism between the fixed and movable platens greatly affects the quality of molded products. The parallelism in the vertical direction is conventionally adjusted by changing the slant or inclination of the movable platen. In general, the inclination of the movable platen is changed by changing the respective heights of the fixed-platen-side end portion of a support portion between the movable platen and the base frame and the opposite end portion. The heights of the two opposite end portions of the support portion are typically changed by a method using wedges, shims, or bolts.

Japanese Patent Application Laid-Open No. 2009-262514 discloses a technique related to an inclination adjustment method for a movable platen using a bolt-and-wedge assembly. Bolts are used as adjustment elements for adjusting the height of the movable platen above a base of a molding machine. The distal ends of the respective threaded portions of the bolts contact the fixed-platen-side end portion of a support block, which is inserted below the movable platen, and the end portion opposite thereto. Thus, the level of the movable platen in the vertical direction above the base of the molding machine in a position corresponding to each of the bolts can be adjusted by means of a wedge-shaped portion of the support block by rotating the bolts.

In the technique disclosed in Japanese Patent Application Laid-Open No. 2009-262514 described above, a front or rear inclination of the movable platen toward a fixed platen can be adjusted by regulating the vertical positions of the movable platen on the fixed-platen side and the opposite side by means of the wedge-shaped portion of the support block by rotating the bolts. Normally, in this case, the movable platen is designed so that its center of gravity is located at an intermediate point between the positions of contact of the bolts, and the degrees to which the positions are raised are adjusted by the weight of the movable platen. If a mold is mounted on the movable platen, however, the position of the center of gravity may be sometimes changed and shifted from between the positions of contact of the bolts. If the bolts are adjusted in this case, the entire movable platen only moves up and down and its inclination cannot be adjusted, in some cases.

SUMMARY OF THE INVENTION

Accordingly, the object of the present invention is to provide an adjustment mechanism for a movable platen, capable of adjusting the inclination of a movable platen used in an injection molding machine without regard to the position of the center of gravity of the movable platen.

The present invention relates to an adjustment mechanism for a movable platen used in a mold clamping unit of an injection molding machine. The mold clamping unit comprises a fixed platen fixed on a base and a movable platen placed substantially parallel to the fixed platen on the base. The adjustment mechanism for the movable platen includes: a push bolt configured to apply a force to push up the movable platen against a gravitational force; and a pull bolt configured to apply a force to draw in the movable platen in the direction of gravity. The height of the movable platen above the base of the injection molding machine in a plurality of positions at different distances from the fixed platen is adjusted using the push bolt and the pull bolt so that the height and inclination of the movable platen with respect to the fixed platen are adjusted.

The push bolt and the pull bolt may be arranged so that the head portion of the push bolt and the head portion of the pull bolt extend in one direction.

The adjustment mechanism may further include a fixing bolt configured to secure the base and the movable platen to each other, wherein the fixing bolt extends perpendicular to the push bolt and the pull bolt.

The base may include a support portion for the movable platen, the fixing bolt may penetrate the support portion and is secured to the movable platen, and an interval between the support portion and the fixing bolt secured to the movable platen may be set as an adjustable range of the height of the movable platen above the base of the injection molding machine and the inclination of the movable platen with respect to the fixed platen.

According to the present invention, the inclination of a movable platen used in an injection molding machine can be adjusted without regard to the position of the center of gravity of the movable platen.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and features of the present invention will be obvious from the ensuing description of embodiments with reference to the accompanying drawings, in which:

FIG. **1** is a schematic view of a mold clamping unit of an injection molding machine incorporating a first embodiment of an adjustment mechanism for a movable platen according to the present invention;

FIG. **2** is a schematic view of a mold clamping unit of an injection molding machine incorporating a second embodiment of the adjustment mechanism for a movable platen according to the present invention;

FIG. **3** is a sectional view taken along line A-A' of FIG. **2**; and

FIG. **4** is an enlarged view of a portion B in FIG. **3**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A mold clamping unit of an injection molding machine incorporating a first embodiment of an adjustment mecha-

nism for a movable platen according to the present invention will first be described with reference to FIG. **1**.

The mold clamping unit of the injection molding machine shown in FIG. **1** operates in the same manner as in the prior art.

In the present embodiment, a support portion **20** is provided on a base frame to which a fixed platen **33** is secured, and one or more push bolts **12** (**12***a* and **12***b*) and one or more pull bolts **14** (**14***a* and **14***b*) are arranged between the base **20** and the movable platen **30**.

The push bolts **12** are screwed into the movable platen **30** and are configured so that their distal end portions contact the upper surface of the support portion **20**. If the push bolts **12** are screwed in, their distal end portions press the upper surface part of the support portion **20**, thereby pushing up the movable platen **30**. Thus, that part of the movable platen **30** corresponding to the push bolts **12** is raised by a distance equal to the lift.

On the other hand, the pull bolts **14** are screwed into both the movable platen **30** and the support portion **20**. If the pull bolts **14** are screwed in, their head portions push down the movable platen **30**, thereby drawing in the movable platen **30** in the direction of gravity. Thus, that part of the movable platen **30** corresponding to the pull bolts **14** is lowered by a distance equal to the depression.

According to the example of FIG. **1**, one (**12***b*) of the two push bolts **12** is located closest to the fixed platen **33**, while the other (**12***a*) is located farthest from the fixed platen **33**. The two pull bolts **14***a* and **14***b* are arranged between the two push bolts **12***a* and **12***b*.

Conventionally, only the push bolts **12** are used to push up the movable platen **30**. If a mold is mounted on the movable platen **30** so that the center of gravity of the movable platen **30** is shifted from between the push bolts **12**, for example, the entire movable platen **30** only moves up and down and its inclination cannot be adjusted even though the push bolts **12** are adjusted. If the pull bolts **14** are also provided, as in the present embodiment, however, the inclination of the movable platen **30** can be adjusted without regard to the position of the center of gravity of the movable platen **30**.

In the present embodiment, the push bolts **12** and the pull bolts **14** are respectively provided in pairs. However, the number of these bolts can be suitably set as far as at least on push bolt **12** and at least one pull bolt **14** are provided. Therefore, the positions where the push bolts **12** are to be screwed into the movable platen **30** need not always be the two positions closest to and farthest from the fixed platen **33**. Further, the positions where the pull bolts **14** are to be screwed into both the movable platen **30** and the support portion **20** need not always be intermediate between the two push bolts **12***a* and **12***b* , either.

In the present embodiment, furthermore, the support portion **20** is provided on a guide between the movable platen **30** and the base frame, and the movable platen **30** is disposed on the support portion **20**. Alternatively, however, the movable platen **30** may be disposed directly on the guide without the use of the support portion **20**.

A mold clamping unit of an injection molding machine incorporating a second embodiment of the adjustment mechanism for a movable platen according to the present invention will now be described with reference to FIG. **2**.

The present embodiment differs from the first embodiment in that two fixing bolts **16** (**16***a* and **16***b*) are arranged horizontally (at right angles to the axes of tie-bars **41**) on a support portion **20** on a base frame. As shown in FIG. **3**, the fixing bolts **16** are passed individually through through-holes in each support portion **20** and their distal ends are threadedly engaged with a movable platen **30**. The support portion **20** is firmly secured to the movable platen **30** by the fixing bolts **16**.

Further, the fixing bolts **16** extend perpendicular to push bolts **12** and pull bolts **14** and horizontally connect each support portion **20** to the movable platen **30**. Thus, the inclination of the movable platen **30** can be adjusted by the push and pull bolts **12** and **14** with the fixing bolts **16** loosened. Even if the fixing bolts **16** are tightened after the inclination of the movable platen is adjusted, the tightening does not affect the result of the adjustment by the bolts **12** and **14**, since the tightening direction of the fixing bolts **16** is perpendicular to the extending direction of the bolts **12** and **14**.

The fixing bolts **16** are passed individually through the through-holes (FIG. **3**) in each support portion **20** and their distal ends are threadedly engaged with the movable platen **30**. Since the inner diameter of each through-hole in the support portion **20** is larger than the outer diameter of each fixing bolt **16**, as shown in the enlarged view of FIG. **4**, a gap **22** is formed between each through-hole of the support portion **20** and the fixing bolt **16** that penetrates the through-hole. In the present embodiment, the size of the gap **22** determines a range in which the inclination of the movable platen **30** is adjustable. It is unnecessary, therefore, to separately provide a mechanism for restricting the adjustable range for the inclination of the movable platen **30**, so that the number of parts used can be reduced.

In the present embodiment, the push bolts **12** and the pull bolts **14** are respectively provided in pairs, as in the first embodiment shown in FIG. **1**, and the fixing bolts **16** are provided in a pair. However, the number of these bolts **12**, **14** and **16** can also be suitably set. Further, the movable platen **30** and the tie-bars **41** may or may not be provided with a sliding portion each. Furthermore, a linear guide or slide guide can be used as the guide between the movable platen **30** and the base frame. In the case where the linear guide is used, it is bound in all other directions than the direction in which it normally moves back and forth. Thus, even if a pulling-up force is generated by the pull bolts **14**, it does not affect the guide function. Also in the case where the slide guide is used, it is only necessary to provide a lift prevention mechanism for preventing the pull bolts **14** from causing a lift.

The invention claimed is:

1. An adjustment mechanism for a movable platen used in a mold clamping unit of an injection molding machine, wherein

the mold clamping unit comprises a fixed platen fixed on a base and a movable platen placed substantially parallel to the fixed platen on the base; the adjustment mechanism for the movable platen comprising:

a push bolt configured to apply a force to push up the movable platen against a gravitational force; and

a pull bolt configured to apply a force to draw in the movable platen in the direction of gravity, wherein

the height of the movable platen above the base of the injection molding machine in a plurality of positions at different distances from the fixed platen is adjusted using the push bolt and the pull bolt so that the height and inclination of the movable platen with respect to the fixed platen are adjusted.

2. The adjustment mechanism according to claim **1**, wherein

the push bolt and the pull bolt are arranged so that a head portion of the push bolt and a head portion of the pull bolt extend in one direction.

3. The adjustment mechanism for a movable platen according to claim **1**, further comprising:

a support portion moveable on the base, and

a fixing bolt configured to secure the support portion and the movable platen to each other, wherein the fixing bolt extends perpendicular to the push bolt and the pull bolt.

4. The adjustment mechanism for a movable platen according to claim **3**, wherein

the fixing bolt penetrates the support portion and is secured to the movable platen, and

an interval between the support portion and the fixing bolt secured to the movable platen is set as an adjustable range of the height of the movable platen above the base of the injection molding machine and the inclination of the movable platen with respect to the fixed platen.

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